

November 2, 1999

Office of Food Labeling (HFS-465)

Center for Food Safety and Applied Nutrition Food and Drug Administration 200 C Street, S.W. Washington, D.C. 20204 UNIVERSITY OF NEVADA SCHOOL OF MEDICINE

Nutrition Education and Research Program Redfield Building/153 Reno, Nevada 89557-0046

To Whom It May Concern:

I am writing to support the petition for a health claim filed by Lipton regarding the association between vegetable oil sterol esters (VOSE) and reduced risk of coronary heart disease (CHD). I have carefully reviewed the data and am impressed with the studies demonstrating both efficacy and safety of the products as proposed. I feel that the claim is in line with standards which serve as the basis of other health claims and the scientific evidence presented thoroughly address issues of efficacy in reducing blood cholesterol levels.

It is important that consumers be truthfully informed regarding the potential of health promoting food products along with any adverse consequences. In this regard, it is evident that Lipton has carefully considered all options of normal usage and role of their products in the diet, nutritive value, mechanism of action, safety, adverse effects, overall effects on HDL as well as LDL, and total cholesterol levels, and optimum dosage levels. I have followed the activities of Lipton with their VOSE enriched spreads and dressings and have observed them to be extremely conscientious and conservative in their approach to product development and marketing their products in the line of functional foods Vs supplements.

Approximately 250 mg of phytosterols are consumed daily as part of the average US diet. The normal levels of dietary phytosterol intake range from approximately 78 mg/day to 343 mg/day. VOSE have also been recognized as GRAS for their intended use in spreads and dressing. Additionally, the acceptable daily intake (ADI) of 130 mg/kg/day as free phytosterols has been established and the level of 7800 mg/day for a 60 kg person is far beyond that which would be attained through the recommended use of the sterol enriched food products. The response effect of 1.6 g/d of sterol ester (1 g/d sterol) in lowering total-and LDL-cholesterol levels at least 5% and 7% is the basis of the proposed claim. As part of a diet low in saturated fat and cholesterol, as recommended, and as a substitute for similar food products currently used, these new foods can contribute significantly to reducing the risk of CHD, especially in the population with moderately elevated lipid levels.

As a former member of the 1995 US Dietary Guidelines Advisory Committee and current member of the Nutrition Committee and the Industry Nutrition Advisory Panel for the American Heart Association, I am keenly aware of the need for responsible and informative food labeling. Additionally, in my work as a registered dietitian advising patients and professor of clinical medicine teaching medical students and physicians, I recognize that health claim issues are critically important. Thus, responsible and accurate health claims will help us better guide our patients into improved diets and health practices and help better educate our physicians and other health professionals. Of importance is the long-term dietary practices and how the new foods fit into a healthful diet overall. VOSE are necessarily added to spreads and salad dressings because of their fat solubility and should be exempt from certain regulatory requirements that would otherwise not permit a health claim, as Lipton has proposed.

I thank the FDA for their work and careful consideration of important issues regarding food labeling.

Sachiko T. St. Jeor, Ph.D., R.D.

Professor and Director



UNIVERSITY OF MASSACHUSETTS AMHERST

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November 1, 1999

Office of Food Labeling (HFS-465)
Center for Food Safety and Applied Nutrition
Food and Drug Administration
200 C Street, S.W.
Washington, D.C. 20204

To the Food and Drug Administration:

I have been asked by Lipton to provide comments on my views on the company's petition for a health claim for vegetable oil sterol esters and their effect on risk reduction of heart disease. In particular I have been asked to provide my opinion on the weight of the evidence provided in meeting the standard of significant scientific agreement. I am familiar with the petition and with the data that support it. I am also familiar with the scientific standard that has formed the basis for approval of other health claims, including those for soluble fiber from psyllium seed husk whole oats and fruits and vegetables.

My professional experience is in the field of Food Science and Nutrition and in the past 10 years I have been very involved with the relationships between science and policy to protect the public as well as to reduce the risk of disease. I am currently Professor and Head of the Department of Food Science at the University of Massachusetts, Amherst. My professional activities have included service on the Keystone National Policy Dialogue on Food, Nutrition and Health, the FDA Food Advisory Committee (1994-1998), the Food and Nutrition Board of the Institute of Medicine (1994-1997, 1997 through 2000), National Academies, Institute of Medicine Committee on Research Opportunities in Nutrition and Food Science (1990-1993), Oversight Committee of the NCI Designer Foods Program (1991) and many others including the U.S. Senate Select Committee on Nutrition and Human needs. In addition I was invited to Chair the FDA Working Panel to evaluate Olestra (Nov. 14-17, 1995) and currently Chair the Food Forum of the Institute of Medicine. I am the editor of the Journal Critical Reviews in Food Science and Nutrition, Associate Editor of the John Wiley and Sons Encyclopedia of Food Science and Technology, Editor of a Book Series (CRC Press) on Food Science and serve on the Editorial Boards of the Journals, Trends in Food Science and Technology and Nutraceuticals World. My primary research activities have included research on anthocyanins, flavonoids, micronutrients and fiber. Our studies have been particularly focused on the interaction of micronutrients (Fe, Ca, Mg, Zn) with other food components such as fiber and how such interactions may: 1) Effect micronutrient bioavailibility and 2) Optimize fiber-bile acid binding to reduce cholesterol via interference with the enterohepatic cycle. As well I have been intimately involved with science policy issues and have published widely in this area over the last 10 years. A copy of my curriculum vitae is attached. Based on my professional experience, I am familiar with scientific standards for reviewing studies for health claims in general and for cholesterol-reducing agents and for cholesterol reducing foods/ingredients, in particular.

In my opinion, the association between vegetable oil sterol esters and reduced risk of CHD is supported by a broad range of clinical experience in a wide variety of subjects over many years. The cholesterol-reducing properties of phytosterols, particularly beta-sitosterol, is well established. This conclusion has been thoroughly discussed in the literature (for example, Pollack and Kritchevsky, 1981) and is well accepted by the scientific and medical community.

The chemistry of vegetable oil sterol esters indicates strongly that they will have a cholesterol-reducing effect similar to that of unesterified phytosterols. As Lipton's petition describes, the esterified vegetable oil sterols will be metabolized in the gut, cleaving the ester bond and releasing the phytosterols, predominantly beta-sitosterol.

Studies of vegetable oil sterol esters confirm that they do in fact reduce cholesterol levels when formulated into everyday foods such as vegetable oil spreads. The lowest tested level, about 1 g per day (in two servings), was associated with an LDL-cholesterol reduction of about 7%, with no significant effect on HDL-cholesterol levels (Hendriks et al., 1999). Other reported reductions were consistent or higher. In my view, these levels represent clinically meaningful cholesterol reductions consistent with other food/ingredients which have had health claims approved.

When considered in total, it is my opinion that the data linking cholesterol reduction with consumption of vegetable oil sterol esters are reproducible and robust. These data indicate that the association between vegetable oil sterol esters and reduced risk of CHD meets the standard of significant scientific agreement

I also support Lipton's request that vegetable oil sterol esters be exempt from certain regulatory requirements that would otherwise not permit a health claim on the labeling of foods containing this substance. This support is based not only on their ease of use and efficacy in lowering cholesterol but also on the fact that the products containing phytosterols are being marketed as replacements for existing products that consumers use. That is, Liptons is not attempting to market these products so that overall uptake will increase, but rather is offering them as a healthy alternative to present usage.

I believe that this product is exactly what Congress had in my mind when NLEA was promulgated because it provides an increased health benefit from food in common usage.

Thank you for your consideration.

Sincerely,
Mulydul

F. M. Clydesdale Professor and Department Head

FMC:mp Enc.

RESUME

Name: Fergus M. Clydesdale

Address: 94 Sugarloaf Street, South Deerfield, MA 01373

Telephone: Business (413)545-2275 - Home (413)665-3851

FAX: (413)545-1262 - e-mail:fergc@foodsci.umass.edu

EDUCATION:

University of Toronto, Ontario, Canada B.A. (1960) Food Chemistry University of Toronto, Ontario, Canada M.A. (1962) Food Chemistry University of Massachusetts, Amherst, MA Ph.D. (1966) Food Science & Technology

University of Massachusetts, Amherst, MA Post-Doctoral Fellow -

Feb. 1, 1966 - Feb. 1, 1967 Food Science and Technology

HONORS:

. Prince of Wales Gold Medal (1960) Awarded to the top graduating senior at Victoria College, University of Toronto.

. National Research Council of Canada Scholarship (1961).

. IFT - General Foods Fellowship (1964).

. University of Massachusetts Distinguished Teacher Award (1972). (Three awards presented per year on a University-wide basis from among 1500 faculty).

. William V. Cruess Award for Excellence in Teaching - presented by the Institute of Food Technologists, 1976.

. Distinguished Food Scientist Award - co-recipient with F.J. Francis, presented by the New York Section of the IFT, 1978.

. Elected to Fellow of the Institute of Food Technologists, 1979.

Recipient of the Third Annual Ethel Austin Martin Visiting Professorship in Human Nutrition at South Dakota State University, January 1983.

. Recipient of the Lectureship Award from the Philadelphia Section of the IFT for "Dedicated Service and Outstanding Contributions to Food Science and Technology", 1983.

Recipient of the 1984 Babcock Hart Award, presented by the Institute of Food Technologists "to honor a person who has distinguished himself/herself by research contributions to food technology which have resulted in improved public health through some aspect of nutrition or more nutritious foods".

. Named the F.W. Tanner Lecturer by the Chicago Section of the Institute of Food Technologists, 1985.

Donald K. Tressler Award for Outstanding Contributions to Food Science and Technology and their Communication to both Scientific Peers and the Public. Presented by the Institute of Food Technologists 1986.

. Named the Ethel Austin Martin Distinguished Lecturer for 1986. South Dakota State University.

Elected to an Honorary Fellow of the Australian Institute of Food Science and Technology. 1987.

. Recipient of the 1989 Nicholas Appert Award presented by the Institute of Food Technologists to honor a person for preeminence in and contributions to the field of food technology.

Elected to President of Phi Tau Sigma, the National Food Science Honors Society, 1992.

Recipient of the 1993 Charles A. Black Award for scientific accomplishment and communication presented by the Council for Agricultural Science and Technology (CAST).

- Named the G. Malcolm Trout Visiting Scholar at Michigan State University, 1993.
- . Named the 1993 Centennial Visiting Professor by the Tokyo University of Fisheries.
- Recipient of the Carl R. Fellers Award for bringing honor and recognition to the profession of Food Science. Presented by the Institute of Food Technologists, 1995.
- . Named a Fellow of the American College of Nutrition, 1996.
- . Named the Ernest Newberry Memorial Lecturer for the 14th International SAAFoST Congress in Pretoria, South Africa, 1997.

HONORARY SOCIETIES:

Sigma Xi, Phi Kappa Phi, Phi Tau Sigma. (President, 1992) President University of Massachusetts Chapter of Sigma X, 1986-1987.

PROFESSIONAL SOCIETIES:

American College of Nutrition (Fellow)
Institute of Food Technologists (Fellow)
American Chemical Society
American Association for the Advancement of Science
Inter-Society Color Council of America
Society for Nutrition Education
American Institute of Nutrition
International Association of Milk, Food and Environmental Sanitarians

ACADEMIC EXPERIENCE:

Professor and Head, July 1, 1989 - present. Department of Food Science. Director of the University of Massachusetts Food Science Strategic Research Alliance 1996 - present.

Co-chair of the University Life Sciences Steering Committee 1996 - 1998. Acting Head - Sept. 1988-June 30, 1989. Department of Food Science and Nutrition, University of Massachusetts.

Adjunct Professor - Sept. 1, 1988 - present. Department of Human Nutrition, Universite Laval, Quebec, Canada.

Professor - September 1976 to September, 1988, Department of Food Science
and Nutrition, University of Massachusetts.

Visiting Food Scientist - January 1976 to July 1976. Department of Food Science Technology, University of California, Davis, California.

Associate Professor - February 1972 to September 1976, Department of Food Science and Nutrition, University of Massachusetts.

Assistant Professor - April 1967 to February 1972, Department of Food Science, University of Massachusetts.

Post Doctoral Appointment - 1966-67, Department of Food Science, University of Massachusetts.

Research Associate - 1962-66, Department of Food Science, University of Massachusetts.

Instructor - 1961-62, Department of Food Chemistry, University of Toronto,
Toronto, Canada.

Research Associate - 1960-61, Department of Food Chemistry, University of Toronto, Toronto, Canada.

INDUSTRIAL AND GOVERNMENT EXPERIENCE:

- Chemist, Canadian Industries Limited, Paint Research and Development
 Laboratories Carried out product development of automotive and retail
 paints. Followed this by conducting storage studies, stability tests and
 complete quality testing of products developed which were deemed to have
 a marketable value.
- Physiological Chemist, Defense Research Medical Laboratories, Canadian Department of National Defense. Investigated the effect of high pressure oxygen on the metabolic pathways of gamma-amino butyric acid in rats.

SELECTED PROFESSIONAL EXPERIENCE IN ACADEMICS:

a. Research:

Director of research grants in color and appearance of foods and the chemical changes involved in processing, with emphasis on minerals, pigments, and dietary fiber. Have graduated over 20 Ph.D. candidates and a similar number of M.S. candidates.

b. Teaching:

Food Science and Nutrition FS&N 850, Colorimetry and Appearance (graduate course).

FS&N 860, Pigment Chemistry (graduate course).

FS&N 101, The Struggle for Food (average enrollment is 300 students per semester). Total overall responsibility, teach 50%.

FS&N 391A, Senior Seminar in Product Development.

FS&N 385, Special Problems in Food Science.

FS&N 872, Graduate seminar.

Organized short courses in Food Color Measurement and Thermal Processing as well as Symposia.

c. Administration and Counseling (Selected Responsibilities):

Director and Coordinator of the Undergraduate resident instruction program in the Department of Food Science during the 1970's.

Past Chairman of the College of Food and Natural Resources Educational Policies Committee.

Past Member of the College of Food and Natural Resources Educational Policies Committee.

Have served as both a member and chairman of the Food Science Personnel Committee which makes recommendations on salary, promotion and tenure.

Overall responsibility for counseling undergraduate majors in Food Science during the 1980's.

Past Chairman of the Food Science Undergraduate-Faculty Liaison Committee.

Past member of the Food Science Graduate-Faculty Liaison Committee. Actively involved with University summer student and parent counseling program.

Past Chairman of the Food Science Undergraduate Curriculum Committee. Member of the University Standing Advisory Committee to the Center for Instructional Resources and Improvement.

Chairman of the University Distinguished Teacher Award Committee (1974). Member of the Search Committee for a Director of the University Center for Instructional Resources and Improvement (1974).

Member of the Search Committee for a Dean of the College of Food and Natural Resources (1976).

Member of the Search Committee for a Department Head in the Department of Food Science and Nutrition (1978).

Chairman of the Food Science and Nutrition Departmental Research Coordination Committee (1979).

Past Member of the Food Science and Nutrition Graduate Policies Committee in Food Science and Nutrition.

Invited participant in a University Workshop sponsored by the Provost and Vice Chancellor for Deans and Department Heads on Working with the Media, 1985 and on University Outreach in 1996.

Member of the University Employee Assistance Program Board, 1982-1986.

Member of the College of Food and Natural Resources Committee on Teaching Improvement 1989-1991.

Member, University Life Sciences Steering Committee, 1995.

Co-Chair, University Life Sciences Steering Committee, 1996-present.

Member, University Committee on Science and Technology Advancement, 1996-present.

PROFESSIONAL SOCIETY OFFICES:

- . Past Chairman of the Education Committee of the North East Section of the Institute of Food Technologists.
- . Inter-Society Color Council Delegate to the National Institute of Food Technologists.
- . Chairman of the IFT Communications Committee on Food Safety and Nutrition from its inception in 1972 to 1978.
- . Member of the IFT Sub-committee on Nutrition Education (1973).
- . Member of the Graduate Jury Awards Committee of the IFT (1975-76).
- . Member of the IFT Committee on Graduate Education (1974).
- . Member of the North East Section IFT Professional Relations Committee (1974-76).
- . Nominated to the Board of Directors of the Inter-Society Color Council of America (1976).
- . Member of the William V. Cruess Awards Committee of the IFT (1976-79).
- . Member of the Program Committee of the IFT (1976-79).
- . Chairman of the Program Committee for the 1981 Annual Meeting of IFT.
- . Member of the IFT Communications Committee on Food Safety and Nutrition. 1972 to present.
- . Chairman of the Expert Panel on Scientific Affairs of the IFT, 1986 to 1994.
- . Elected to Membership on the IFT Executive Committee 1987-90.
- . Member of the IFT Policy Board of the Office of Scientific Public, Affairs. 1986-1993.
- . Elected to the IFT Council (1989-92).
- . Elected as a member and Secretary of the Board of Trustees of the North American Division of the International Life Sciences Institute (1990-present).
- Elected as a member of the Board of Trustees of the International Life Sciences Institute (1990-present).
- . Scientific Advisor to the Food Nutrition and Safety Committee of the International Life Sciences Institute Nutrition Foundation (1986-1990).
- . Chair of the Scientific Advisors of the Food Nutrition and Safety Committee of the International Life Sciences Institute (1990-present).

EDITORIAL BOARDS:

Editor of Critical Reviews in Food Science and Nutrition, CRC Press.
Editor of the CRC Book Series in Food Science and Nutrition.
Past Member of the Editorial Board of Advances in Food Research,
Academic Press.

Associate Editor of a new Encyclopedia of Food Science and Nutrition, John Wiley and Sons.

Member of the Editorial Board of Trends in Food Science and Technology, Elsevier Publishing Company.

Member of the Editorial Board of the Journal of Food Protection.

Past Member of the Editorial Board of the Journal Color Engineering.

Past Member of the Editorial Board of the Journal of Food Science.

PUBLICATIONS:

- 325 Technical Publications (see attached).
- 20 Books and Monographs
- 250 Invited Presentations to technical societies, industrial groups consumer groups, radio and TV (past 5 years).

GRANTS (selected)

Have been a co-principal investigator or principle investigator of grants from NIH, USDA, the Department of Defense, Industry, Trade Associations, Institutes and Foundations, as well as participating in regional Hatch projects over the past 20 years.

CONSULTANTSHIPS (selected)

Have acted and am acting as a consultant to several major U.S. and international food companies.

Serve on or chair Scientific and Technical Advisory Boards and Committees for a number of major food companies and government agencies.

Served as a consultant to the University of Florida Agricultural Research and Education Center, Lake Alfred, Florida, in color chemistry and to the National Science Foundation as a member of overview committees.

Consulted for the Institute of Nutrition, University of North Carolina, Chapel Hill, North Carolina and Purdue University, Harvard University and Tufts in the area of curriculum design.

APPOINTMENTS AND PRESENTATIONS (selected)

Appointed to Chair the Food Forum of the Food and Nutrition Board of the Institute of Medicine National Academy of Science, 1996-1999.

Chaired the FDA Working Panel to evaluate Olestra, November 14-17, 1995.

Appointment to the Food Advisory Committee of the Food and Drug Administration, 1994-1998.

Appointed to the Food and Nutrition Board of the Institute of Medicine, National Academy of Sciences 1994-1997. Reappointed 1997-2000.

Appointed to the Keystone Committee on National Policy Dialogue on Food, Nutrition and Health 1993-1996.

Appointed to the National Academy of Sciences, Institute of Medicine Committee on Research Opportunities in Nutrition and Food Science 1990-1993.

Appointed to the Oversight Committee of the Designer Foods Program, in the National Cancer Institute, 1991.

Appointed to the Expert Panel on "Emerging Issues in Food Safety and Quality During the Next Decade". This was a panel of the Life Sciences Research Office of the Federation of American Societies for Experimental Biology to advise the Food and Drug Administration for the 1990's. (1989)

Appointed to the United States Senate Select Committee on Nutrition and Human Needs as a member of the panel on Nutrition and the Consumer. (1974).

Appointed to the National Academy of Sciences - National Research Council Board on Agriculture Committee "Scientific and Regulatory Issues Underlying Pesticide Use Patterns and Agricultural Innovations". 1985-87.

Appointed to the National Academy of Sciences - National Research Council General Committee on the DOD Food Program. 1974-77. Reappointed to this committee for a three year term in 1978.

Appointed to the National Academy of Sciences - National Research Council Committee on Food Service Systems. 1974-77. Reappointed - 3 year term, 1978.

Appointed to the Committee on General Nutrition Education of the Pennsylvania State University Nutrition Education Conference Workshop. 1974.

Elected to the Board of Governors of Food Update of the Food and Drug Law Institute, (1984-87).

Appointed to the Board of Advisors of Brigham Young University Ezra Taft Benson Agricultural Institute, (1983-1991).

Invited to present a paper at the 4th International Congress of Food Science and Technology, Madrid, Spain. 1974.

Invited to present papers at the Gordon Research Conference on Food and Nutrition, in 1974 and 1975.

Invited to testify at the Federal Trade Commission Hearings on Food Advertising, in 1976 and 1977.

Invited to submit testimony to Subcommittees on both the House and Senate on several occasions.

Invited to present an address to the Royal Canadian Institute (Canada's oldest scientific society), 1979.

Invited to present the Annual Lecture to the British Nutrition Foundation, London, England. (1979).

Invited to present a paper at the 6th Annual Congress of the International

Nutritional Anemia Consultative Group in Santiago, Chile, 1981, sponsored by AID.

Invited to present a paper to a joint meeting of the British Nutrition Foundation and the Soc. Chem. Ind. London, England, 1986.

Keynote speaker at the annual meeting of the Australian IFST, 1987. Albury, Australia.

Ellen Park, 14th Annual Memorial Lecture. Univ. of Toronto, 1987.

Invited to present one of four Plenary Papers at the Opening Session of the 50th Anniversary Annual Meeting of the Institute of Food Technologists, Chicago, IL, 1989.

Invited as the Foreign Speaker to present the main lecture at the 50th Anniversary of the Finnish Meat Research Institute in Hameenlinna, Finland. August, 1990.

Invited to present a Plenary Paper at the 8th World Congress of Food Science and Technology, Toronto, Canada, October 1991.

Invited to present a paper at the International Congress of Nutrition in Adelaide, Australia, October 1993.

Invited to present the Centennial Lecture at the Tokyo University of Fisheries, 1993.

Invited to present a paper at the Unilever Research Center, Celebratory Symposium at Colworth House, Bedford, England. 1995.

Invited to present a paper at the 16th International Congress of Nutrition in Montreal Canada, 1997.

Invited to present the Ernest Newbury Memorial Lecture at the 14th South African Institute of Food Science and Technology International Congress, Pretoria, South Africa, 1997.

Invited to present the opening address at the Celebratory Scientific Symposium, of 25th Anniversary" Euro R&D Center, CPC Europe 35th Anniversary" Institute for Research and Development, CPC Germany, 1997.

OUTREACH:

Initiated, organized and serve as Director of the new University of Massachusetts Food Science Strategic Research Alliance which has 20 member Companies.

Formalized the utilization of our Pilot Plant by State Industries.

Began a series of seminars which led to an off campus MS program at Company Headquarters within the State.

Began a certification program for scientific personnel in a Connecticut Company.

Actively involved in teaching short courses to industry as a means of updating current techniques.

Informal counseling to several major food industries, on regulatory issues, health, nutrition and technology.

Work in close cooperation with the State Food Industry and with local groups and organizations.

Presented some 120 lectures to public interest groups in the past five years.

PERSONAL PUBLICATIONS

Original Research:

Wood, J.D., W.J. Watson and F.M. Clydesdale. 1963. Gamma-Amino-butyric Acid and Oxygen Poisoning. Journal of Neurochemistry, 10:625-633.

Clydesdale, F.M. and C.H. Podlesney, Jr. 1968. A Computer Program for the Interconversion of Color Data. Color Engineering, 6(3):55-56.

Clydesdale, F.M. and F.J. Francis. 1968. A study of chlorophyll changes in thermally processed spinach as influenced by enzyme conversion and pH adjustment. Food Technol., 22(6):135-138.

Clydesdale, F.M. and F.J. Francis. 1969. Color Measurement in Foods: Correlation of Raw, Transformed and Reduced Data with Visual Ratings for Spinach Puree. Food Sci., 34:349-352.

Clydesdale, F.M. and C.H. Podlesny, Jr. 1968. Addition to a Computer Program for the Interconversion of Color Data. Color Engineering, (6),24.

Lin, Yi-Do, F.M. Clydesdale and F.J. Francis. 1970. Organic Acid Profiles of Thermally Processed Spinach. J. Food Sci., 35:641-644.

Huang, I-Lo, F.J. Francis and F.M. Clydesdale. 1970. Colorimetry of Foods: Color measurement of squash using the Kubelka-Munk concept. J. Food Sci., 35:315-317.

Huang, I-Lo, F.J. Francis and F.M. Clydesdale. 1970. Colorimetry of Foods: Carrot puree. J. Food Sci., 35:771-773.

Fleischmann, D.L., F.M. Clydesdale and F.J. Francis. 1970. Effect of magnesium carbonate and sodium phosphate on the extraction of chlorophyll-like pigments after thermal processing of spinach puree. J. Milk and Food Technol., 33:456-459.

Lin, Yi-Do, F.M. Clydesdale and F.J. Francis. 1971. Organic Acid Profiles of Thermally Processed, Stored Spinach Puree. J. Food Sci., 36:240-242.

Clydesdale, F.M., D.L. Fleischmann and F.J. Francis. 1970. Maintenance of Color in Processed Green Vegetables. Food Product Development, 4(5):127-138.

Clydesdale, F.M., A.W. Goodman and F.J. Francis. 1971. The effect of a phosphate buffer and magnesium carbonate of quality attributes of cooked green vegetables. J. Milk and Food Technol., 34:78-81.

Clydesdale, F.M., Y.D. Lin and F.J. Francis. 1972. Formation of 2-pyrolidone-5-carboxylic acid from glutamine during processing and storage of spinach puree. J. Food Sci., 37:45-47.

Lin, Y.D., F.M. Clydesdale and F.J. Francis. 1972. A simplified method for the analysis of glutamine. J. Food Sci., 37:488-489.

Ehmann, E.P., R.A. Ageloff and F.M. Clydesdale. 1972. A multipurpose colorimetric computer program. Food Product Development, 6:111-112.

- Gullett, E.A., F.J. Francis and F.M. Clydesdale. 1972. Colorimetry of Foods: 5. An orange beverage Tang. Can. Inst. Fd. Sci. Tech. J., 5(1):32-36.
- Gullett, E.A., F.J. Francis and F.M. Clydesdale. 1972. Colorimetry of Foods: 4. Orange Juice. J. Food Sci., 37:389-393.
- Driver, M., F.J. Francis and F.M. Clydesdale. 1976. Colorimetry of Dry Breakfast-Type Cereals. J. Food Sci., 41:1353-1356.
- Bibeau, T.C., F.M. Clydesdale and F.M. Sawyer. 1974. Glutamine as a predictive measurement in the quality assessment of carrot puree. J. Food Sci., 2:365-367.
- Johnson, L., F.M. Clydesdale and F.J. Francis. 1976. The use of colorimetric data to predict chemical and visual changes in solution. 4th International Congress of Food Science and Technology. Vol. II:150-159.
- Chu, N.T., F.M. Clydesdale and F.J. Francis. 1973. Isolation and identification of some fluorescent phenolic compounds in cranberries. J. Food Sci., 38:1038-1042.
- Eagerman, B.A., F.M. Clydesdale and F.J. Francis. 1973. Comparison of color scales for dark colored beverages. J. Food Sci., 38:1051-1055.
- Eagerman, B.A., F.M. Clydesdale and F.J. Francis. 1973. Development of new transmission color scales for dark colored beverages. J. Food Sci., 38:1056-1059.
- Bibeau, T.C. and F.M. Clydesdale. 1975. Organic acid profiles of thermally processes carrot puree. J. Milk and Food Technol., 38(9):518-520.
- Chu, N.T. and F.M. Clydesdale. 1976. Decomposition of organic acids during processing and storage. J. Milk and Food Technol., 39:477-480.
- Chu, N. T. and F.M. Clydesdale. 1976. Reactions between amino acids and organic acids. Reaction of tryptophan and alpha-ketoglutaric acid. J. Food Sci., 41:895-898.
- Chu, N.T. and F.M. Clydesdale. 1976. Reactions between amino acids and organic acids. Reaction of tryptophan and pyruvic acid. J. Food Sci., 41:891-894.
- Chu, N. and F.M. Clydesdale. 1975. The effect of concentration, thermal processing, and storage temperature on the interaction between alphaketoglutaric acid and tryptophan. J. Milk and Food Technol. 38(10):573-580.
- Johnson, J., F.M. Clydesdale and F.J. Francis. 1975. Use of expanded color scales to predict chemical and visual changes in solutions. J. Food Sci., 41:74-77.
- Bibeau, T.C. and F.M. Clydesdale, 1976. Variations in organic acid profiles of thermally processed green beans of different varieties Phaseolus vulgarus L. J. Milk and Food Technol., 39:536-538.
- Bibeau, T.C. and F.M. Clydesdale. 1978. Thermal Stability of Subsidiary Dyes Associated with FD&C Yellow No. 6. J. Food Sci., 43(2):521-523.

Eagerman, B.A., F.M. Clydesdale and F.J. Francis. 1977. Determination of fresh meat color by objective methods. J. Food Sci., 42:707-710.

Anderson, N.E. and F.M. Clydesdale. 1978. Estimation of tryptophan content by spectrophotometric methods: Analysis of the interaction between alphaketoglutaric acid and tryptophan. J. Food Protection. 41(3):163-167.

Anderson, N.E. and F.M. Clydesdale. 1978. Analysis of tryptophan utilizing its reaction with alpha-ketoglutaric acid. J. Food Sci., 43:1595-1599.

Eagerman, B.A., F.M. Clydesdale and F.J. Francis. 1978. A rapid method for following changes in myoglobin in beef muscle. J. Food Sci., 43:468-469.

Main, J.H., F.M. Clydesdale and F.J. Francis. 1978. Spray drying anthocyanin concentrates for use as food colorants. J. Food Sci., 43:1693-1694.

Bibeau, T.C. and F.M. Clydesdale. 1978. Thermal Stability of Subsidiary dyes in Red #2. Can. J. Food Sci. and Technol., 11(4):173-176.

Lee, K. and F.M. Clydesdale. 1979. Quantitative determination of the elemental, ferrous, ferric, soluble and complexed iron in foods. J. Food Sci., 44:540-554.

Kostyla, A.S. and F.M. Clydesdale. 1979. Psychophysical relationships between color, flavor, aroma, sourness and sweetness in a red cherry flavored beverage. Presented at IFT meeting, Dallas, 1978.

Clydesdale, F.M., J.H. Main, F.J. Francis and R.H. Damon. 1978. Concord grape pigments as colorants for beverages and desserts. J. Food Sci., 43:1687-1692, 1697.

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